CLAIMS

What is Claimed is:

1. An apparatus for facilitating processing of a plurality electronic component assemblies, comprising:

a first platen including a plurality of sets of alignment elements projecting therefrom, the sets of alignment elements configured and positioned for cooperatively engaging sets of alignment features of a like plurality of electronic component assemblies arranged in a plurality of mutually laterally spaced locations over the first platen; and

a second platen including a plurality of component cavities extending therethrough at a plurality of mutually laterally spaced locations corresponding to the locations over the first platen, the second platen further including a plurality of sets of alignment element receptacles configured and positioned to respectively receive therein the plurality of sets of alignment elements with the second platen superimposed on the second platen.

2. The apparatus of claim 1, wherein the alignment elements comprise pins.

3. The apparatus of claim 1, wherein each set of alignment elements comprises at least two alignment elements located adjacent each component cavity of the plurality.

4. The apparatus of claim 1, wherein each component cavity of the plurality is divided into a plurality of subcavities separated by strut members.

5. The apparatus of claim 4, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen.

6. The apparatus of claim 5, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members.

7. The apparatus of claim 1, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen.

8. The apparatus of claim 7, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members.

9. The apparatus of claim 1, wherein the plurality of component cavities are each sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

10. The apparatus of claim 9, wherein each component cavity of the plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

11. The apparatus of claim 10, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen, each component cavity of the another plurality sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

12. The apparatus of claim 11, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

13. The apparatus of claim 1, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen, each component cavity of the another plurality sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

14. The apparatus of claim 13, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

15. The apparatus of claim 1, further comprising structure releasably securable to at least one of the first platen and the second platen and configured for selective securement of the second platen in superimposition to the first platen.

16. The apparatus of claim 1, wherein at least one of the first platen and the second platen further includes platen alignment features sized, configured and arranged to cooperatively engage a plurality of platen alignment elements projecting thereinto.

17. An apparatus for fabrication of articles, comprising:

a stereolithography system structured for formation of material in at least a semi-solid state in at least one layer to form a structure abutting a pre-existing workpiece located within a vision field above a platform of the stereolithography system, the platform having platen assembly alignment elements projecting therefrom;

a machine vision system in operable communication with the stereolithography system including at least one camera oriented for detecting objects within the vision field;

a computer in operable communication with both the stereolithography system and the machine vision system, the computer being programmed to respond to input from the machine vision system indicative of the presence, location and orientation of at least one workpiece in the vision field and to initiate and control the stereolithography system to form at least one structure of at least one layer of at least semi-solid material abutting the at least one workpiece;

a first platen including a plurality of sets of alignment elements projecting therefrom, the sets of alignment elements configured and positioned for cooperatively engaging sets of alignment features of a like plurality of electronic component assemblies arranged in a plurality of mutually laterally spaced locations over the first platen, the first platen further including platen assembly alignment features engaged with the platen assembly alignment elements; and

a second platen including a plurality of component cavities extending therethrough at a plurality of mutually laterally spaced locations corresponding to the locations over the first platen, the second platen further including a plurality of sets of alignment element receptacles configured and positioned to respectively receive therein the plurality of sets of alignment elements with the second platen superimposed on the second platen.

18. The apparatus of claim 17, wherein the alignment elements comprise pins.

19. The apparatus of claim 17, wherein each set of alignment elements comprises at least two alignment elements located adjacent each component cavity of the plurality.

20. The apparatus of claim 17, wherein each component cavity of the plurality is divided into a plurality of subcavities separated by strut members.

21. The apparatus of claim 20, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen.

22. The apparatus of claim 21, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members.

23. The apparatus of claim 17, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen.

24. The apparatus of claim 23, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members.

25. The apparatus of claim 17, wherein the plurality of component cavities are each sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

26. The apparatus of claim 25, wherein each component cavity of the plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

27. The apparatus of claim 26, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen, each component cavity of the another plurality sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

28. The apparatus of claim 27, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

29. The apparatus of claim 17, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen, each component cavity of the another plurality sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

30. The apparatus of claim 29, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

31. The apparatus of claim 17, further comprising structure releasably securable to at least one of the first platen and the second platen and configured for selective securement of the second platen in superimposition to the first platen.

32. An apparatus for facilitating processing of a plurality of electronic components, comprising:

a frame member including frame alignment features configured for cooperative engagement with frame alignment elements projecting from a platform of a stereolithography apparatus;

a film suspended under tension within the frame member;

an adhesive coating on the film, the adhesive coating formulated to exhibit adhesive characteristics reducible responsive to exposure to at least one selected wavelength of radiation.

33. The apparatus of claim 16, wherein the at least one selected wavelength of radiation falls within a range of wavelengths in the ultraviolet band of wavelengths.

34. An apparatus for fabrication of articles, comprising:

a stereolithography system structured for formation of material in at least a semi-solid state in at least one layer to form a structure abutting a pre-existing workpiece located within a vision field above a platform of the stereolithography system, the platform having frame alignment elements projecting therefrom;

a machine vision system in operable communication with the stereolithography system including at least one camera oriented for detecting objects within the vision field;

a computer in operable communication with both the stereolithography system and the machine vision system, the computer being programmed to respond to input from the machine vision system indicative of the presence, location and orientation of at least one workpiece in the vision field and to initiate and control the stereolithography system to form at least one structure of at least one layer of at least semi-solid material abutting the at least one workpiece;

a frame member including frame alignment features cooperatively engaged with the frame alignment elements;

a film suspended under tension within the frame member;

an adhesive coating on the film, the adhesive coating formulated to exhibit adhesive characteristics reducible responsive to exposure to at least one selected wavelength of radiation.

35. The apparatus of claim 34, wherein the at least one selected wavelength of radiation falls within a range of wavelengths in the ultraviolet band of wavelengths.

36. A method of processing electronic component assemblies, comprising:

disposing a plurality of electronic component assemblies in fixed positions secured to a platen assembly with one side of each of the electronic component assemblies including electronic components exposed through the platen assembly;

securing the platen assembly to a platform within a stereolithography apparatus with the exposed electronic components on the one side of the electronic component assemblies facing upward;

forming at least one stereolithographic structure adjacent each of the exposed electronic components on the one side of the electronic component assemblies; and

removing the platen assembly from the stereolithgraphy apparatus.

37. The method of claim 36, wherein disposing a plurality of electronic component assemblies in fixed positions secured to the platen assembly with one side of each of the electronic component assemblies including electronic components exposed through the platen assembly further comprises disposing a plurality of electronic component assemblies in fixed positions secured to the platen assembly with another, opposing side of each of the electronic component assemblies including electronic components exposed through the platen assembly.

38. The method of claim 37, further including:

after forming at least one stereolithographic structure adjacent each of the exposed electronic components on the one side of the electronic component assemblies, inverting the platen assembly;

securing the inverted platen assembly to a platform within a stereolithography apparatus with the exposed electronic components on the another, opposing side of the electronic component assemblies facing upward; and

forming at least one stereolithographic structure adjacent each of the exposed electronic components on the another, opposing side of the electronic component assemblies.

39. The method of claim 38, wherein inverting the platen assembly is effected prior to removal thereof from the stereolithography apparatus.

40. The method of claim 38, wherein inverting the platen assembly is effected after the removal thereof from the stereolithography apparatus and securing the platen assembly to a platform within a stereolithography apparatus with the exposed electronic components on the another, opposing side of the electronic component assemblies facing upward comprises securing the platen assembly to a platform within a second stereolithography apparatus.

41. The method of claim 38, wherein inverting the platen assembly is effected after the removal thereof from the stereolithography apparatus and securing the platen assembly to a platform within a stereolithography apparatus with the exposed electronic components on the another, opposing side of the electronic component assemblies facing upward comprises securing the platen assembly to the platform within the same stereolithography apparatus.

42. A method of processing electronic components, comprising:

adhering a plurality of electronic components in fixed positions to one side of a film supported by a frame member;

securing the frame member to a platform within a stereolithography apparatus with the electronic components adhered to the one side of the film facing upward;

forming at least one stereolithographic structure adjacent each of the electronic components adhered to the one side of the film; and

removing the frame member from the stereolithgraphy apparatus.

43. The method of claim 42, further comprising, after removing the frame member from the stereolithography apparatus, inverting the frame member and releasing the plurality of electronic components from the film.

44. The method of claim 43, wherein releasing the plurality of electronic components from the film comprises exposing the film to ultraviolet radiation from a side thereof opposite the side to which the plurality of electronic components are adhered.

45. The method of claim 43, wherein releasing the plurality of electronic components from the film comprises releasing the plurality of electronic components into a tray divided into cells, each electronic component being released into a single cell.

46. The method of claim 45, further comprising forming at least one stereolithographic structure adjacent each of the electronic components while the electronic components are located in the cells of the tray.

47. The method of claim 45, further comprising placing structures to effect external electrical communication on each of the electronic components while the electronic components are located in cells of the tray.

48. The method of claim 43, wherein releasing the plurality of electronic components from the film comprises adhering the plurality of electronic components to another film.

49. The method of claim 48, further comprising forming at least one stereolithographic structure adjacent each of the electronic components while the electronic components adhered to the another film.

50. The method of claim 48, further comprising placing structures to effect external electrical communication on each of the electronic components while the electronic components are adhered to the another film.

51. An apparatus for fabrication of articles, comprising:

a stereolithography system structured for formation of material in at least a semi-solid state in at least one layer to form a structure abutting a pre-existing workpiece located within a vision field of the stereolithography system, the stereolithography system further including a platen assembly support structure configured for engagement of a platen assembly and enabling rotation of a platen assembly engaged therewith about a horizontal axis;

a machine vision system in operable communication with the stereolithography system including at least one camera oriented for detecting objects within the vision field; and

a computer in operable communication with both the stereolithography system and the machine vision system, the computer being programmed to respond to input from the machine vision system indicative of the presence, location and orientation of at least one workpiece in the vision field and to initiate and control the stereolithography system to form at least one structure of at least one layer of at least semi-solid material abutting the at least one workpiece.

52. The apparatus of claim 51, further including a platen assembly engaged with the platen assembly support structure, the platen assembly comprising:

a first platen including a plurality of sets of alignment elements projecting therefrom, the sets of alignment elements configured and positioned for cooperatively engaging sets of alignment features of a like plurality of electronic component assemblies arranged in a plurality of mutually laterally spaced locations over the first platen, ; and

a second platen including a plurality of component cavities extending therethrough at a plurality of mutually laterally spaced locations corresponding to the locations over the first platen, the second platen further including a plurality of sets of alignment element receptacles configured and positioned to respectively receive therein the plurality of sets of alignment elements with the second platen superimposed on the second platen.

53. The apparatus of claim 52, wherein the alignment elements comprise pins.

54. The apparatus of claim 52, wherein each set of alignment elements comprises at least two alignment elements located adjacent each component cavity of the plurality.

55. The apparatus of claim 52, wherein each component cavity of the plurality is divided into a plurality of subcavities separated by strut members.

56. The apparatus of claim 55, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen.

57. The apparatus of claim 56, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members.

58. The apparatus of claim 52, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen.

59. The apparatus of claim 58, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members.

60. The apparatus of claim 52, wherein the plurality of component cavities are each sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

61. The apparatus of claim 60, wherein each component cavity of the plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

62. The apparatus of claim 61, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen, each component cavity of the another plurality sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

63. The apparatus of claim 62, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

64. The apparatus of claim 52, wherein the first platen further includes another plurality of component cavities therethrough at a plurality of mutually laterally spaced locations corresponding to the plurality of mutually laterally spaced locations over the first platen, each component cavity of the another plurality sized and configured to provide lateral clearance about a plurality of electronic components projecting from a carrier substrate of an electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

65. The apparatus of claim 64, wherein each component cavity of the another plurality is divided into a plurality of subcavities separated by strut members, and wherein the plurality of subcavities are each sized and configured to provide lateral clearance about one or more electronic components projecting from a carrier substrate of the electronic component assembly having a set of alignment features engaged with a set of alignment elements projecting from the first platen and received in a set of alignment element receptacles of the second platen.

66. The apparatus of claim 52, further comprising structure releasably securable to at least one of the first platen and the second platen and configured for selective securement of the second platen in superimposition to the first platen.

67. A method of forming solder balls on an active surface of at least one semiconductor die, the method comprising:

providing at least one semiconductor die having a plurality of bond pads or trace ends over an active surface thereof;

placing the at least one semiconductor die in an orientation with the active surface thereof facing upwardly;

using a directed beam of radiation to selectively cure portions of a curable liquid material overlying the active surface to form a dielectric layer including apertures formed therethrough located over at least some of the bond pads or trace ends; and

placing discrete conductive elements in contact with the bond pads or trace ends through the apertures.

68. The method of claim 67, wherein placing the discrete conductive elements in contact with the bond pads or trace ends comprises forming the discrete conductive elements in the apertures.

69. The method of claim 68, wherein forming the discrete conductive elements in the apertures further comprises:

forming the apertures to have a lateral dimension larger than a lateral dimension of bond pads or trace ends aligned therewith

placing a volume of solder paste into the apertures sufficient to fill the apertures to an upper extent of the dielectric layer; and

heating the at least one semiconductor die to melt the solder in the solder paste and form solder balls projecting above the dielectric layer.

70. The method of claim 69, wherein placing a volume of solder paste into the apertures comprises placing solder paste over the active surface and removing solder paste from the active surface above the upper extent of the dielectric layer.

71. The method of claim 70, wherein providing at least one semiconductor die comprises providing a plurality of semiconductor dice.

72. The method of claim 71, wherein providing the plurality of semiconductor dice comprises providing a plurality of unsingulated semiconductor dice.

73. The method of claim 67, wherein providing at least one semiconductor die comprises providing a plurality of semiconductor dice.

74. The method of claim 73, wherein providing the plurality of semiconductor dice comprises providing a plurality of unsingulated semiconductor dice.